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REPLY TO
ATTENTION OF

MCVS

15 October 1999

MEMORANDUM FOR

COMMANDERS, REGIONAL VETERINARY COMMANDS
DIRECTOR, DOD MILITARY WORKING DOG VETERINARY SERVICE
DIRECTOR, DOD VETERINARY LABORATORY

SUBJECT: Veterinary Command (VETCOM) Policy Memorandum - Guide to the Salvage of Chilled/Frozen Foods Exposed to Refrigeration Failure

1. This policy memorandum will establish U.S. Army Veterinary Command policy for the inspection of chilled/frozen foods exposed to refrigeration failures.
2. This memorandum provides policies and procedures for the VETCOM inspection of temperature abused food products. Veterinary assistance in reducing salvage condemnation losses related to refrigeration failures is a value-added service to all our customers. This guide was developed through research conducted at US Army Soldier Systems Command, Natick Research Development and Engineering Center Sustainability Directorate.
3. Veterinary Command personnel must be prepared and responsive to refrigeration failures to properly support the customer and ensure safe, wholesome food is provided for issue and/or resale. The major goal of this new guide is to reduce waste by replacing the practice of *when in doubt, throw it out*. The objectives of the new guide are to provide scientific-based guidelines concerning food safety when making disposition decisions on temperature stressed foods and to furnish a more user-friendly guide than currently exists. This guide is different from previous ones developed in that it takes into account the risk of emerging bacteria that are capable of growing at refrigeration (chill) temperatures. Background information is available from the AMEDD Center and School, Food Technology and Sanitation Branch, the *Scientific Basis of the Guide* may be obtained upon request. The guide does not go beyond the temperature of 25⁰C/77⁰F and three-day exposure time from the

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onset of the refrigeration failure. It is emphasized that the guide's focus is microbial safety. The classification, *MELT* has been eliminated enabling the retailer a wide latitude for making quality judgements concerning thawed *SAFE* foods.

4. There are five basic steps involved in making disposition decisions of food items exposed to refrigeration failures. The five steps are as follows:

Step 1 - Determine the length of time the food has been stressed at an ambient temperature of 6⁰C/42⁰F or greater.

Step 2 - Classify the temperature stressed food item as *SAFE* or *RISK* based on Table 1 and Figure 2. If the food item is a *Risk* item, then decide which *RISK* Group it belongs to.

Step 3 - Determine the product temperature.

Step 4 - Determine if the food item has exceeded its Time-Temperature Limit based on Table 2.

Step 5 - Make disposition decision.

*THE FOLLOWING PARAGRAPHS (5-9) ARE PROVIDED FOR TRAINING PURPOSES.

5. STEP 1 - ESTIMATING THE TIME OF EXPOSURE:

a. The estimation of exposure time is for the ambient temperature and not the product temperature. This is a conservative safety factor that has been designed into the system. Refrigeration units should be equipped with electronic warning devices that not only trigger an alarm but also record the time when refrigeration failure occurs. When such devices are unavailable, one should assume the worst case scenario of refrigeration failure occurring which would be shortly after the last person has left the store (not including cleaning personnel).

b. The time of refrigeration failure may be deduced

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from the stoppage of an electric clock or if it was a general blackout, by an inquiry of the electric company. Time-Temperature Indicators have been developed that can provide a good indication of the time that temperatures have exceeded the requirements. Record the estimated time of exposure on the Refrigeration Failure Form. A sample form is provided.

6. STEP 2 - CLASSIFICATION OF FOODS

a. Stressed foods will be classified as either *SAFE* or *RISK* food items. Determine if the food item is listed as a *SAFE* food by reviewing Table 1. For *SAFE* items, refrigeration is used to maintain quality, not control pathogen growth. Factors contributing to reduced microbial risk include low pH (acidic) and/or a_w (reduced availability of water.) All items that have remained frozen are included in the *SAFE* list. Resale decisions concerning temperature stressed *SAFE* foods will be made by the retailer. Mark, tag, separate or remove the *SAFE* foods.

b. If the food is not listed as *SAFE* in Table 1, then go to Figure 2, *Flow Chart for Classifying Foods Exposed to Refrigeration Failure* to determine the risk level. Record *RISK* foods and their risk level on the Refrigeration Failure Form.

7. STEP 3 - DETERMINE PRODUCT TEMPERATURE

a. Determine whether the refrigeration failure was due to a power outage or mechanical breakdown and note it on the Refrigeration Failure Form. In a power outage, all electrical systems are off, a temperature gradient emerges with the bottom layer being the coldest. During a mechanical breakdown, when the fans and compressor are still working, the middle layer is the coldest portion of a lot. The top outermost packages will thaw faster than the internal packages, therefore lot arrangements may include;

(1) the removal of the outer packages or stacks

from the lot to be discarded or

(2) the splitting of a lot into two or more smaller lots
or,

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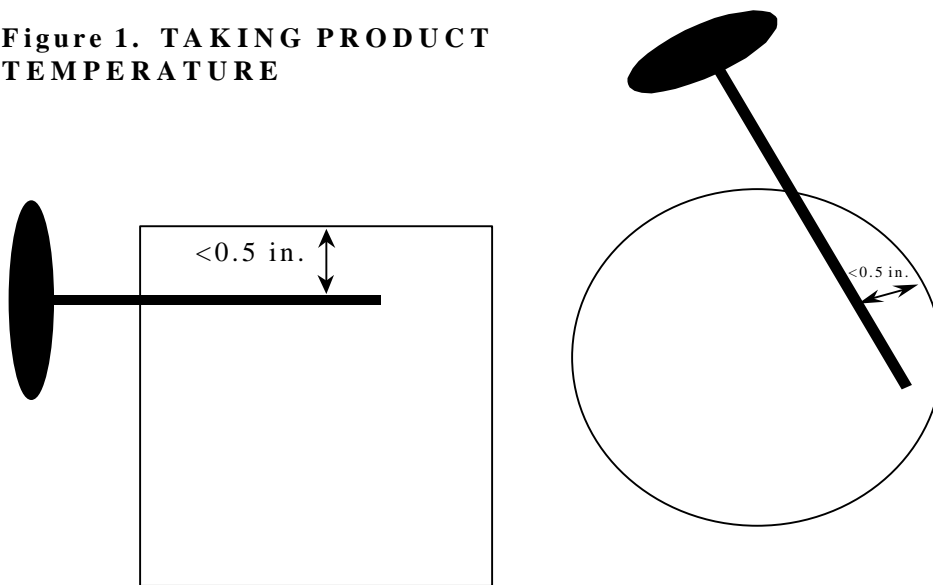
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(3) both 1 and 2.

Place priority on frozen items if the refrigeration failure total time is greater than 24 hours. Care must be taken to avoid cross-contamination between risk and safe foods.

b. Locate the two warmest portions of a lot, which are usually the outer corners of the corner packages of the top layer; an exception is the occurrence of a mechanical failure in which the fans continually circulate the air around the lot. Take two temperature readings from the top layer and note the higher reading and time on the *Refrigeration Failure Form*. Thermometer penetration should be parallel to the surface of the sample but will not exceed 0.5 inch below the parallel surface (see Figure 1).

Figure 1. TAKING PRODUCT TEMPERATURE



*Internal product temperatures will be taken, do not take the temperature between boxes. Do not allow the sensing portion of the thermometer to penetrate deeper than 0.5 inches parallel to the product surface.

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8. STEP 4 - DETERMINE IF THE FOOD HAS EXCEEDED THE TIME-TEMPERATURE LIMITS

Compare exposure times with the time-temperature limits (Table 2). The first column in Table 2 is the actual temperature of the RISK item and the next three columns are time limits for exposure to a refrigeration failure. If temperatures are taken in Fahrenheit and the temperature readings are between the temperatures in column 1, use the next highest reading. These provide the guideposts for deciding the disposition of RISK foods. Once the temperature has been determined, simply match (horizontally) that temperature with the appropriate RISK column to determine if the RISK item has exceeded the time limits.

9. STEP 5 - MAKE DISPOSITION DECISION

a. If the exposure times are within the time-temperature limits during a mechanical or power failure, then accept the whole lot for salvage. If the exposure times exceed the time-temperature limits during a mechanical failure when fans are on, then reject the top and bottom layers and take the temperatures of the second layer. Continue this procedure until all layers have been rejected or time-temperature limits are complied with. When a layer is found within the time-temperature limits, accept the remaining lot. If the exposure times exceed the time-temperature limits when fans are not on, then reject and remove the top layer and continue to take temperatures of the new top layer (working from the top to bottom) until the lot is rejected or time-temperature limits are in compliance.

b. Reject all RISK items that have exceeded the time-temperature limits. Reject all RISK 3 items if exposed to $\geq 6^{\circ}\text{C}/42^{\circ}\text{F}$ for four hours or more, unless these are raw flesh food (chilled or frozen), or unopened pasteurized dairy/egg products and do not show signs of spoilage. These products can be displayed under refrigeration (chilled/frozen) for a period of up to 24 hours. The packaging should include a highly visible label stating: **WARNING: POTENTIALLY HAZARDOUS IF NOT HANDLED PROPERLY**. Instructions should also be placed at the display case explaining proper handling (keep refrigerated, wash hands and utensils after contact with them, avoid contact of item with cooked foods, **COOK THOROUGHLY** the same day of purchase).

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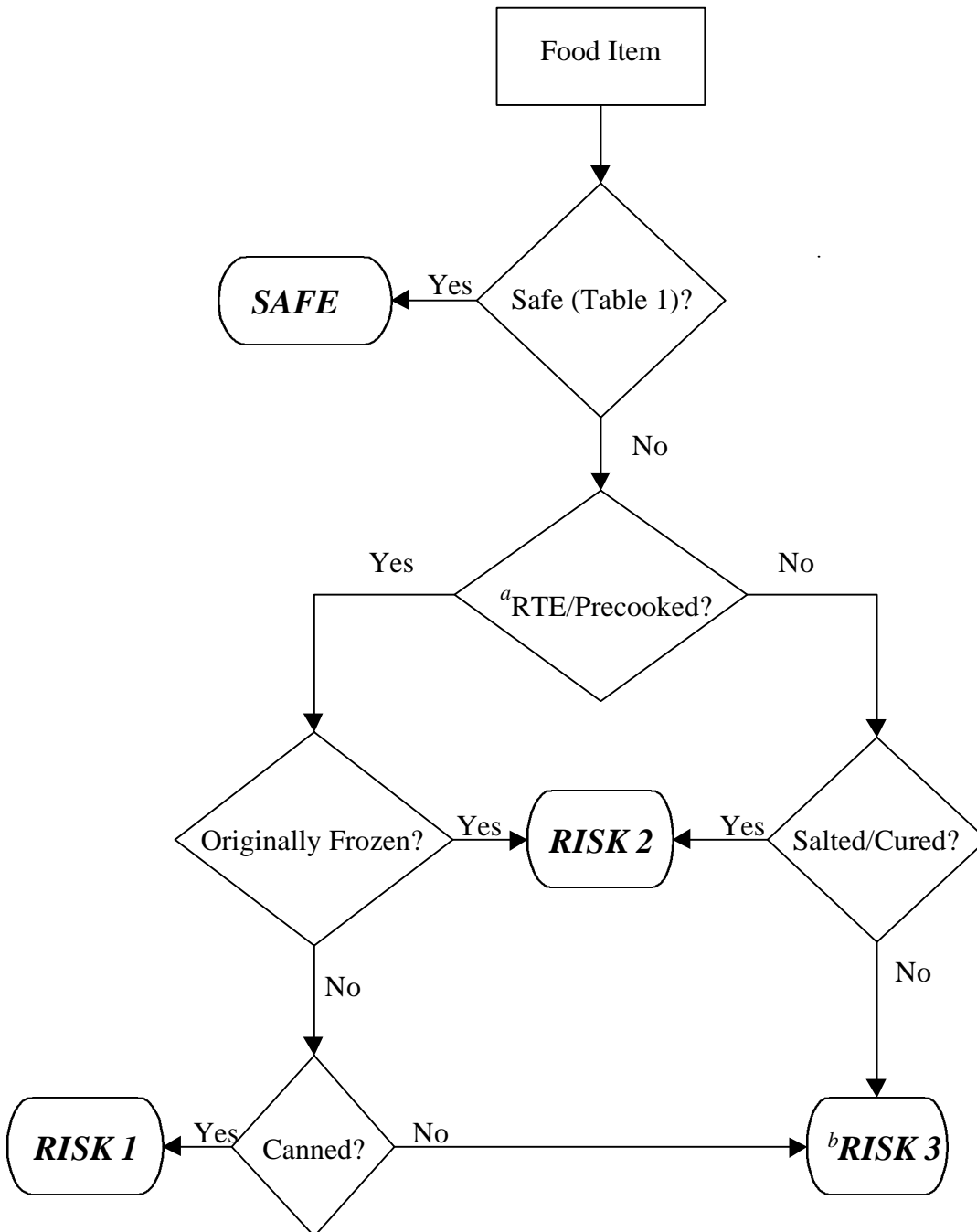
Table 1. LIST OF SAFE FOODS

<i>Miscellaneous items</i>	<i>Fruits and Vegetables</i>
Dough, ready-to-bake	Fruit, cut-up or sliced (except melons)
Pastries, without cream, custard or meat fillings	Fruit salad
Pie crust	Fruit in syrup
Popcorn	Fruit juices, concentrates, drinks
Pizza, cheese, pepperoni, anchovy	Horseradish sauce
Tortilla	Salad dressing
Yeast, bakers	Salsa
Frozen items not defrosted	Sauerkraut
<i>Dairy Display Items²</i>	Vegetables, raw, chilled or frozen, excluding cut-up products and bean sprouts
Butter	
Cheese, processed	
Cheese, ripened, hard or semihard ¹	<i>Meat items²</i>
Cream cheese	Bacon, dry cured
Dips, sour cream base	Bacon bits (refrigerate after opening)
Pickled herring, shrimp	Ham, canned (refrigerate after opening)
Lard	Pepperoni
Margarine	Salami, hard
Sour cream	Sausages, fermented
Yogurt	Fish, dried/salted

1. Soft and semisoft cheeses are not considered "safe foods." Soft/semisoft cheeses include Brie, Camembert, Feta, Hand, Neufchatel, Ricotta, Cambridge, Convalli, Little Dutch, Port du Salut, Bel Paese, Bondon, Coulommiers, Gerome, Petit Suisse, Romadur, Cottage cheese, and Liptau.

2. See page 5 (para. 9.b.) for disposition of pasteurized dairy/egg products and raw flesh foods.

Figure 2. FLOW CHART FOR CLASSIFYING FOODS EXPOSED TO REFRIGERATION FAILURES



a - RTE - Ready to Eat

b - See page 5 (para. 9.b.) for disposition of pasteurized dairy/egg products and raw flesh foods.

Table 2. TIME-TEMPERATURE LIMITS

TIME-TEMP LIMITS	RISK 1	RISK 2	RISK 3 ^a
°C/°F	HOURS	HOURS	HOURS
6/42	72	72	4
7/44	72	72	4
8/45	72	48	4
9/47	72	29	4
10/50	72	24	4
11/52	59	18	4
12/54	47	15	4
13/55	39	12	4
14/57	31	11	4
15/59	29	9	4
16/61	26	7	4
17/63	24	7	4
18/64	21	6	4
19/66	19	5	4
20/68	17	5	4
21/70	15	4	4
22/72	13	4	4
23/73	11	3	4
24/75	9	3	4
25/77	7	2	4

a-See page 5 (para 9.b.) for disposition of pasteurized dairy/egg products and raw flesh foods.

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10. Knowledge of the properties of various refrigerated foods, along with the knowledge of behavior of pertinent foodborne pathogens, provides a framework to assess the type of health risks that are likely to be encountered in the event of a refrigeration failure. Therefore, the ecology of the four food groups are briefly reviewed.

a. Flesh Foods. Raw meat, poultry and seafood are the most perishable of foods since they contain an abundance of nutrients and moisture content required for growth of bacteria, yeast and molds. Because of their high growth rate, bacteria are the primary spoilage organisms and health risks. Vacuum packaging of chilled meats increase their shelf life by the reduction in oxygen content and a concomitant increase in carbon dioxide. This set of conditions is especially effective in inhibiting the growth of the primary spoilage organisms, the pseudomonads. The addition of salt, which reduces a_w , also prevents the proliferation of spoilage organisms. Yeast and other bacteria are not as affected on some food items, such as sausage and bacon, and will eventually spoil these chilled foods. Lowering the pH of meats, as in fermented sausages, is effective in controlling the growth of spoilage organisms and some pathogens.

b. Fruits and Vegetables. Although adequate in nutrients and moisture content, raw, unprocessed vegetables are attacked by only a few bacteria. Cooking and cutting destroy their resistance to microbial attack. The lack of B vitamins in fruits, and their low pH, prevent the growth of most microorganisms except the molds and yeast. Exceptions to the general acidity of fruits are the melons, that due to their lower acidity levels, allow enteric pathogens to grow.

c. Dairy Products. Milk is an excellent growth medium for all types of microorganisms. Raw milk generally contains various species of microorganisms, but pasteurization temperatures eliminate all but the sporeformers, and a few

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thermodurics, such as the lactics. Post-pasteurization contamination may result in the growth of gram negative bacteria and reduction of shelf life. The low a_w and pH of most ripened cheeses results in a long shelf life. However, certain soft cheeses, especially the surface of mold-ripened cheeses, have a high enough a_w and pH to permit growth of pathogens.

d. Bakery Products. The baking process destroys all but the sporeformers in bread and cakes. The low a_w of the products inhibit most microorganisms except molds that eventually would spoil these products. Of course, baked goods with meat or cream fillings would facilitate the growth of bacterial pathogens. Spoilage of fresh, refrigerated dough products is caused mainly by lactic acid bacteria.

11. Classification of Foods based on Microbial Risks.

a. In terms of public health risks, the FDA classifies foods into two broad categories: those that support the growth of pathogens (potentially hazardous foods) and those that do not. The former are defined as those with pH values of >4.6 and a_w of >0.85 . This guide extends the utility of the FDA's definition of potentially hazardous foods, in order to facilitate the salvage of foods exposed to refrigeration failures.

b. The guide provides a detailed listing and classification of chilled and frozen products to identify those products of no risk, and therefore can be salvaged. Thus, a classification scheme and products are listed and classified into two main groups, SAFE and RISK. Products under the category of SAFE foods do not allow growth of pathogens, but their degree of stability varies widely in terms of quality. These may include shelf-stable products that are displayed under refrigeration e.g. hard salami and canned ham labeled *refrigerate after opening*. Yogurt developed originally for its stability at room temperature is kept refrigerated to maintain its quality. The guide does not

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extend beyond the public health risk to the consumer. The retailer or commissary officer should be given wide latitude in deciding the quality or marketability of the SAFE foods.

c. Food exposed to refrigeration failures in the RISK category support the growth of pathogens and are divided into two groups based on whether or not they are precooked and/or ready-to-eat. Those that are ready-to-eat (RTE) are considered of higher microbial risk because of the absence of cooking (intervention step) immediately before consumption. Cold-tolerant bacteria cease to grow at freezing temperatures, one can readily obtain a conservative estimation of risk from *L. monocytogenes* with foods categorized as RISK-2. Chilled canned ham is the only product classified as RISK-1. Because of heat processing and the absence of recontamination, only sporeforming *C. botulinum* and *B. cereus* are potential hazards. Items that have the highest potential microbial risk are ready-to-eat, chilled products (RISK-3). Because of the capability of certain pathogens such as *L. monocytogenes* to grow at refrigeration temperatures, it is not possible to determine at what point in time they have started to grow in RISK-3 items, exposed to refrigeration failures.

d. The preparation or cooking of raw RISK foods right before consumption greatly reduces microbial hazards as long as proper sanitary practices are followed, and the food is fully cooked. Two subsets are identified among these raw flesh foods according to whether or not they are salted and/or cured. The main concern for products that are salted/cured (RISK-2) is the potential of *S. aureus* to grow and produce enterotoxins that are impervious to heat. In the absence of salting/curing (RISK-3), *S. aureus* has difficulty in competing with the normal flora of raw flesh foods as discussed previously. For the sake of simplicity, the latter are included as a subgroup of RISK 3 category; The chilled salted/cured uncooked items are classified as a subgroup of RISK 2.

12. Time-Temperature Limits (T.T.L.) Concept

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The concept of T.T.L. estimates the level of exposure to refrigeration failures that one can allow before RISK foods become a *microbial* health risk. The FDA specifies only one T.T.L.: to regard all potentially hazardous (RISK) foods as unacceptable if they reach above 5°C/41°F for over 4 hours. The FDA's guidance is stringent in that its implementation would result in the rejection of many items that would still be wholesome; however, is retained for RISK-3 category (chilled- ready-to-eat) items for reasons previously stated. The T.T.L. concept is a more flexible guide in that it takes into consideration the following: (i) the various types of RISK foods involved and (ii) the relationship of time and temperature in the growth response of pertinent pathogens in these RISK foods.

13. Each Regional Veterinary Command Commander will ensure that their subordinate units receive this policy memorandum.

14. Destroy after two years, when superseded, or discontinuance of organizational element whichever comes first.

15. Point of contact for additional information or clarification is the Food Safety and Public Health Directorate, DSN 471-6510.

Encls

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Commanding